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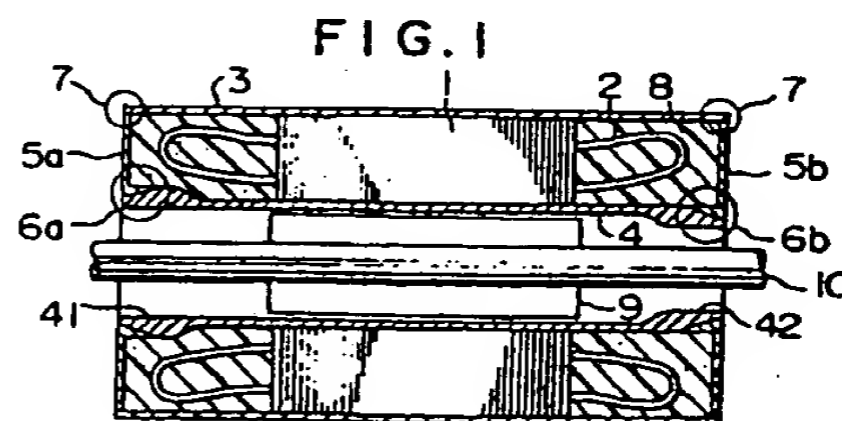
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54 Stator of submerged pump and method of producing same.

57 To produce a stator of a submerged motor of satisfactory quality free from the problem of an eddy current losses requires the provision of cylinders formed of carbon fiber reinforced plastics of superhigh precision. Difficulties have been experienced in producing this type of cylinders in small wall thickness, and the cylinders produced have raised various problems including in ability to be joined with end covers (5a, 5b) in good condition. The problem of how to obtain flawless joints between the cylinders of carbon fiber reinforced plastics and the end covers is solved by providing increased wall thickness portions (6a, 6b) to opposite axial end portions of an inner cylinder (4) near the joints with the ends covers, one increased wall thickness portion (6a) being located at one axial end portion on an outer side surface thereof and the other increased wall thickness portion (6b) being located at the other axial end portion on an inner side surface thereof. Thus the inner cylinder (4) has a small wall thickness at an axial central portion to reduce an eddy current loss while its wall thickness is increased at the opposite axial end portions to improve mechanical strength and facilitate joining the end covers (5a, 5b) to the inner cylinder (4).



STATOR OF SUBMERGED PUMP AND METHOD OF
PRODUCING SAME

1 BACKGROUND OF THE INVENTION

This invention relates to stators of submerged motors and methods of producing same, and more particularly it is concerned with a stator of a submerged
5 motor and a method of producing same which motor may be a motor for use with a water circulating pump or other motor which is capable of operation in the water with high reliability in performance.

Generally, a submerged motor is an induction
10 electric motor in which a rotor substantially producing no voltage is placed in such a manner that its coil conductors are in direct contact with the water. However, a stator coil having a high voltage applied thereto should have a watertight construction because an insulation
15 layer of the coil would have its dielectric strength greatly reduced if it were brought into direct contact with the water. Thus, in motors of medium and small sizes of an output power of below 50 KW, it has hitherto been usual practice to adopt what is generally referred to
20 as a canned system in which the stator is contained in its entirety in a container of stainless steel by filling the gap with a mold resin incorporating inorganic material therein.

As the submerged motors grow in size and output
25 power, it is necessary to increase the wall thickness of

1 a can of stainless steel to meet the requirement of
increasing mechanical strength set by an attendant
increase in the inner diameter and length of the stator.

On an inner side of the container or can,
5 an eddy current loss would be produced by a revolving
magnetic field generated in a gap between the stator
and the rotor. The eddy current loss would be propor-
tional to the thickness of the can and the length of a
stator core, and would be proportional to the third power
10 of the inner diameter of the can. Of course, it would be
proportional to the electric conductivity of the can.
Thus, in submerged motors of large size, the thickness of
the can and the length of the stator core would become
great, resulting in the eddy current loss reaching several
15 per cents of the output power. Such motor could not be
accepted as a motor for practical use.

A very effective method of obviating the
aforesaid problem would consist in using a can of a
composite structure provided by using as material for the
20 inner side of the stator in which an eddy current loss
is produced a material which is high in water shielding
effect and low in eddy current loss (or a material of
low electric conductivity). A carbon fiber reinforced
plastic (hereinafter CFRP for short) would be one example
25 of such materials which meet the requirement. Since a
CFRP has an electric conductivity which is about 1/100
that of stainless steel, it would be possible to reduce
the value of an eddy current loss to a level below 1%

1 that of stainless steel if a sheet of a CFRP of a thick-
ness of 1 - 1.5 mm were used by taking mechanical strength
into consideration. Such low eddy current loss would
pose no problem in putting the canned submerged motor
5 into practical use.

A stator of a submerged motor of the composite
can system of a composite structure using an inner cylinder
of CFRP generally comprises a stator core usually mounted
in the form of a lamination inside an outer cylinder,
10 and a stator coil contained in a slot formed in the stator
core. The inner cylinder of CFRP is fitted to the inner
side of the stator core, and end covers are attached to
opposite ends thereof through inside joints while being
joined to the outer cylinder through outside joints to
15 provide a can. The outer cylinder and the end covers
are usually formed of stainless steel of higher electric
resistance than other metals. An adhesive agent of the
epoxy resin base is used for the inside joints for joining
CFRP and stainless steel together by taking watertightness
20 into consideration. The outside joints may be provided
by welding. By filling the gap in the can with a mold
resin by pouring same through an inlet port formed in
one of the end covers or the outer cylinder and allowing
the poured mold resin to set, it is possible to obtain
25 a stator as a finished article.

The stator of the submerged motor of the aforesaid
construction raises, in putting same to production, a
problem which is difficult to solve, on account of the

1 thickness of the inner cylinder of CFRP being very small
(1 - 1.5 mm). More specifically, to obtain a stator of
a submerged motor of high quality, it is necessary that
the cylinder of CFRP be very high in dimensional accuracy
5 and precision (length, inner and outer diameters, circular
ity, etc.). However, this requirement is hard to satisfy
in articles of small wall thickness.

Generally, in producing a cylinder of CFRP, carbon
fibers are wound on a mandrel of metal and impregnated
10 with a resin which is allowed to harden, and then the
mandrel is withdrawn from a cylindrical object formed
thereon. When the cylindrical object is small in thickness,
irregularities might be caused to occur in the carbon
fibers constituting the cylindrical object or strain might
15 be applied to the hardened resin as the mandrel is withdrawn.
Also, withdrawing of the mandrel might cause a deformation
to occur in the cylindrical object by mechanical force
used for withdrawing. In actual practice, the cylinder of
CFRP of a submerged motor of large size has a diameter in
20 the range between 400 and 500 mm. In articles of this
large size, it is almost impossible to reduce the deformation
to a level below 1 mm. If deformation occurred, the
area of adhesion between the end covers and the cylinder
of CFRP would be reduced, and moreover a satisfactory
25 bond could not be obtained between them because of gaps
existing between them. To improve the bond strength of
the inside joints, it is necessary that the angle of
connection between each end cover and the inner cylinder

1 be reduced to increase the area of adhesion between them.
In the case of articles of small thickness, if the angle
of connection were reduced, a reduction in thickness
caused by the reduction in the angle of connection might
5 result in breaking or stripping of the end portions when
machining is performed, thereby aggravating the deforma-
tion described hereinabove. Thus, in stators of submerged
motors of the composite can type of the prior art described
hereinabove, a problem has been raised with regard to
10 obtaining good joints between the end covers and the inner
cylinder of the can.

SUMMARY OF THE INVENTION

This invention has been developed for the
purpose of obviating the aforesaid problem of the prior art.
15 Accordingly, the invention has as one of its objects the
provision of a stator of a submerged motor wherein the
inner cylinder is of a thickness small enough to reduce
an eddy current loss to a negligible value and yet
satisfactorily good joints can be provided between the inner
20 cylinder and the end covers.

The outstanding characteristic of the invention
which enables the aforesaid object to be accomplished is
that the inner cylinder has its wall thickness varied
at axial opposite end portions thereof in such a manner
25 that one end portion near a joint with one end cover has
an increased thickness on the outer side surface and the
other end portion near a joint with the other end cover

1 has an increased thickness on the inner side surface.

Another object of the invention is to provide a method of production of a stator of a submerged motor which enables a stator core to be fitted in an outer
5 cylinder and allows a rotor to be inserted into the stator with ease.

The disadvantage of the prior art referred to in the description of the background of the invention can be obviated by providing the inner cylinder with the
10 increased thickness portions at axial opposite end portions as described hereinabove. However, this structural arrangement has raised the problem that the provision of an increased thickness portion on the outer side surface of the wall makes it impossible to fit the stator core in
15 the outer cylinder and the provision of an increased thickness portion on the inner side surface of the wall makes it impossible to insert the rotor into the stator. To solve this problem, the invention provides a method of production comprising the steps of supporting a stator core
20 with an ending at the outside by an outer cylinder and supporting the stator core at the inside by an inner cylinder in a predetermined position, the inner cylinder being formed with increased wall thickness portions at axial end portions thereof, one at one end portion on
25 an outer side surface thereof and the other at the other end portion on an inner side surface thereof, the inner cylinder having one end cover joined thereto at the one end portion having the increased wall thickness portion

1 on the outer side surface and moved with the other end
portion having the increased wall thickness portion on
the inner side surface serving as a leading end portion
until the predetermined position is reached; joining
5 another end cover to the other end portion of the inner
cylinder having the increased wall thickness portion on
the inner side surface thereof; joining the end covers
at one end thereof to the outer cylinder to provide a
watertight container; and filling a resin in a vacant
10 space within the watertight container and allowing same to
harden. Thus, the second object is accomplished by the
aforesaid production method.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a sectional view of the stator of
15 the submerged motor comprising one embodiment of the
invention;

Figs. 2, 3, 4 and 5 are sectional views of the
stators of the submerged motors comprising other embodiments;
and

20 Fig. 6 is a sectional view of still another
embodiment of the invention, showing in detail the joint
between the inner cylinder and the end cover.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the invention will now
25 be described by referring to the accompanying drawings.

Fig. 1 shows one embodiment of the stator of

1 the submerged motor in conformity with the invention. As
shown, the stator comprises a stator core 1, a stator
coil 2 inserted into a slot, not shown, formed in the
stator core 1, and an outer cylinder 3 containing the
5 stator core 1 arranged in lamination. An inner cylinder 4
formed of a CFRP is fitted inside the stator core 1,
and end covers 5a and 5b are joined to opposite ends of the
outer and inner cylinders 3 and 4 at outside joints 7, to
thereby provide a can. The construction described herein-
10 above is no different from a stator of a submerged motor of
the prior art. In the stator according to one embodiment
of the invention, the inner cylinder 4 is formed at one
axial end portion with an external reinforcing layer 41
and at the other axial end portion with an internal rein-
15 forcing layer 42 so that the wall of the inner cylinder 4
has a greater thickness at the opposite end portions than
at a central portion thereof. The inner cylinder 4 of
such construction may be readily formed of a CFRP by
using a stepped mandrel having a depression corresponding
20 to the internal reinforcing layer 42. Thus, in the inner
cylinder 4 of CFRP according to the invention, the wall
has a thickness of over 6 mm at opposite end portions
although its thickness in the central portion is in the
range between 1 and 1.5 mm as described hereinabove. By
25 virtue of this feature, the aforesaid defects of the
prior art, such as deformation of the inner cylinder and
breaking and stripping of its end portions, can be
eliminated which might otherwise occur when the inner

1 cylinder is produced and subjected to machining, and the
inner cylinder obtained has a high dimensional accuracy
and precision. Flawless joints can be provided between
such inner cylinder and the end covers.

5 The method of producing the embodiment of the
stator in conformity with the invention will now be
described. First, the end cover 5a is bonded with an epoxy
resin to the tapering external reinforcing layer 41 at
an inside joint 6a, and the inner cylinder 4 is inserted,
10 from the left in Fig. 1, into the stator core 1 provided
with the stator coil 2 and fitted in the outer cylinder 3.
When this operation is performed, the internal reinforcing
layer 42 at the other axial end portion of the inner
cylinder 4 does not interfere with the operation because
15 it is located on the inner side surface of the wall. Then,
another end cover 5b is joined to the internal reinforcing
layer 42 at an inside joint 6b, and the two end covers 5a
and 5b are finally welded to the outer cylinder 3 at the
outside joints 7, to provide a can of composite structure.
20 A mold resin 8 incorporating inorganic material powder
therein is filled in a space within the can as is the
case with the can of the prior art. In this construction,
a rotor 9 can be readily assembled with the stator by
inserting same from the left into the inner cylinder 4.
25 Thus, the provision of the reinforcing layers 41 and 42
at the opposite axial ends of the wall of the inner
cylinder 4 does not interfere with assembling of the rotor
with the stator. An additional advantage offered by

1 the provision of the reinforcing layers 41 and 42 is
that the area of adhesion can be increased over and above
that of the prior art. For example, when the reinforcing
layers have a thickness of 6 mm, the area of adhesion
5 is quadrupled with respect to the inner cylinder of the
prior art (which has a thickness of 1.5 mm), so that
stresses produced in the joints can be reduced to 1/4 those
of the joints of the prior art. This is conducive to in-
creased reliability of the motor in performance.

10 Fig. 2 shows a second embodiment of the invention
which is characterized by the structural feature that the
external and internal reinforcing layers 41 and 42 provided
to the wall of the inner cylinder 4 are threaded on outer
peripheral surfaces thereof, and the end covers 5a and 5b
15 are threaded on inner peripheral surfaces thereof, so
that the end covers 5a and 5b can be joined to the inner
cylinder 4 both adhesively and by threadable engagement.
The embodiment having the aforesaid structural feature
can achieve the same effects as the embodiment shown in
20 Fig. 1. When the end covers 5a and 5b are threadably
attached to the inner cylinder 4 of CFRP, better joints
can be provided than when joints are provided adhesively.
The strength of the joints of the embodiment shown in
Fig. 2 is over five times as high as that of the joints of
25 the embodiment shown in Fig. 1. Leads 11 may be drawn,
when necessary, from the stator coil 2 through the end
cover 5a which is initially joined to the inner cylinder 4.

Fig. 3 shows a third embodiment which is

1 characterized by the fact that the construction of the
embodiment shown in Fig. 2 additionally includes metal
rings 12a and 12b of a material having a coefficient of
linear expansion higher than or equal to that of the
5 material of the end covers 5a and 5b intimately fitted to
the outer and inner reinforcing layers 41 and 42 respec-
tively at their inner peripheral surfaces. In the embodi-
ments shown in Figs. 1 and 2, the CFRP used for forming
the inner cylinder 4 has a lower coefficient of linear
10 expansion ($\alpha \doteq 0$) than the stainless steel (coefficient
of linear expansion, $\alpha \doteq 16 \times 10^{-6}$) used for forming the
end covers 5a and 5b, so that, when there is a temperature
rise, stresses might be produced and act to cause stripping
of the joints. Thus, there is the risk that the end
15 covers might be separated from the inner cylinder after
prolonged use (because the end covers 5a and 5b expand
outwardly and the inner cylinder 4 of CFRP does not expand).
However, if the metal rings 12 and 12b formed as of stain-
less steel are fitted to the inner peripheral surfaces
20 of the outer and inner reinforcing layers 41 and 42,
respectively, in intimate contact relation, then the
aforesaid risk that the end covers might be separated from
the inner cylinder can be avoided. More specifically, a
rise in temperature would cause the metal rings 12 and 12b
25 of stainless steel to expand. Since the modulus of
elasticity of stainless steel is about four times as high
as that of CFRP, the wall of the inner cylinder 4 formed of
CFRP would be stretched to the outer peripheral side as

1 the CFRP expands if the wall of the inner cylinder 4 had
a thickness equal to or greater than that of the reinforcing
layers 41 and 42, with a result that the wall of the
inner cylinder 4 would be brought into still more intimate
5 contact with the end covers 5a and 5b. Also, if a material
of a higher coefficient of linear expansion than the
material for forming the end covers 5a and 5b is used for
forming the metal rings 12a and 12b (iron of $\alpha \div 11 \times 10^{-6}$
for the end covers 5a and 5b and stainless steel for the
10 metal rings 12 and 12b, for example), then it is possible
to increase the bond strength because a rise in temperature
brings a pressure to bear upon the joints. The metal rings
12a and 12b may be fitted to the reinforcing layers 41
and 42 either adhesively or by threadable connection.
15 However, the use of the metal rings 12a and 12b could achieve
better results if they were fitted by expansion fit (the
metal rings are cooled as by liquid nitrogen and fitted in
contracted condition, for example). In the embodiment
shown in Fig. 3, however, it is necessary that the metal
20 rings 12a and 12b be fitted after the rotor 9 is assembled
with the stator.

Fig. 4 shows a fourth embodiment in which the
inner peripheral surfaces of the external and internal
reinforcing layers 41 and 42 are threaded and outer
25 peripheral surfaces of flanges of the end covers 5a and 5b
in contact with the wall of the inner cylinder 4 are also
threaded. The end covers 5a and 5b are threadably con-
nected to the external and internal reinforcing layers 41

1 and 42 respectively while an adhesive layer is being
interposed therebetween. Thus, the flanges of the end
covers 5a and 5b are located on the inner peripheral
surface of the inner cylinder 4 as contrasted with the
5 embodiment shown in Fig. 2 in which they are located on
the outer peripheral surface of the inner cylinder 4. The
embodiment of the construction shown in Fig. 4 can achieve
the same effects as the embodiment shown in Fig. 2. Par-
ticularly, in the embodiment shown in Fig. 4, compressive
10 stresses would be produced at the joints when the temper-
ature rises and no stresses oriented in the direction in
which stripping of the end covers off the inner cylinder
would occur would be produced, thereby eliminating the
need to provide the metal rings 12a and 12b.

15 Fig. 5 shows a fifth embodiment which has, in
addition to the structural feature of the embodiment shown
in Fig. 4, the structural feature that the outer peripheral
surfaces of the external and internal reinforcing layers 41
and 42 are also threaded and the end covers 5a and 5b
20 are each formed with an additional flange extending along
the outer peripheral surface of reinforcing layers 41,
42 and formed with a threaded portion on an inner peripheral
surface thereof. The additional flanges of the end
covers 5a and 5b are threadably connected to the external
25 and internal reinforcing layers 41 and 42 at their outer
peripheral surfaces with an adhesive layer being inter-
posed therebetween. The embodiment of the aforesaid
construction shown in Fig. 5 can achieve the same effects

1 as the embodiments shown and described hereinabove. The
embodiment shown in Fig. 5 offers the additional advantage
that higher reliability in performance can be obtained
because the area of adhesion is increased and the distance
5 of water permeation can be increased along the interface
of adhesion. In the embodiments shown in Figs. 4 and 5,
it is necessary that the operation of attaching the end
cover 5a to the external reinforcing layer 41 of the inner
cylinder 4 be performed after the rotor 9 has been inserted
10 into the stator.

Fig. 6 shows a sixth embodiment in which the
outer peripheral surface of the internal reinforced layer
42 of the wall of the inner cylinder 4 is not threaded
along its entire length but only a portion of the outer
15 peripheral surface located remote from its axial end is
threaded and the rest of the outer peripheral surface is
divergingly tapering in going toward its end, and the
flange of the end cover 5b is threaded only on the inner
peripheral surface of its forward end portion while the
20 rest of the flange is convergingly tapering in going
toward its base. Thus, in attaching the end cover 5b to
the inner cylinder 4, the end cover 5b and the internal
reinforcing layer 42 of the wall of the inner cylinder 4
are threadably connected at their threaded surfaces with
25 an adhesive layer being interposed therebetween and
adhesively joined together at their tapering surfaces.
Although not shown, the end cover 5a and the external
reinforcing layer 41 are of the same construction as

1 the end cover 5b and the internal reinforcing layer 42
described hereinabove.

The embodiment of the aforesaid construction
shown in Fig. 6 can achieve the same effects as the
5 embodiments shown and described hereinabove. The embodi-
ment shown in Fig. 6 offers the additional advantage
that at the joints watertightness is ensured by adhesive
bonding and strength is maintained by threadable con-
nection. Thus, the combined use of adhesive bonding and
10 threadable connection is more advantageous than the use
of threadable connection alone.

In all the embodiments shown and described
hereinabove, the inner cylinder 4 has been described as
being formed of carbon fiber reinforced plastic which is
15 considered to serve the purpose satisfactorily. It should
be noted, however, that the invention is not limited to
this specific material for producing the inner cylinder
4, and that any suitable material, such as plastics
reinforced with glass fibers or metal fibers (such as
20 stainless steel fibers), may be used for producing the
inner cylinder 4 without departing from the scope of the
invention. Also, the invention covers applications in
which any suitable material, such as an epoxy resin added
with inorganic powder material, ceramics, etc., may be
25 used for adhesively joining the end covers to the inner
cylinder, and in which the inner cylinder is formed by
using thin sheet metal, such as stainless steel foil, and
reinforcing material layers are provided to its axial

1 end portions.

From the foregoing description, it will be appreciated that the stator of the submerged motor according to the invention is characterized in that it comprises
5 an inner cylinder having its wall thickness varied at axial end portions thereof in such a manner that one end portion near a joint with one end cover has an increased thickness on the outer side surface and the other end portion near a joint with the other end cover has an
10 increased thickness on the inner side surface. The stator of the submerged motor of the aforesaid construction is produced by a method of production according to the invention in which a stator core provided with a winding is supported at the outside by an outer cylinder, and
15 an inner cylinder including an increased wall thickness portion on the outer side surface of one axial end portion and an increased wall thickness portion on the inner side surface of the other axial end portion and having one end cover joined to the one axial end portion of increased
20 wall thickness on the outer side surface is moved axially from the other axial end portion of increased wall thickness on the inner side surface to a predetermined position where the inner cylinder supports the stator core at the inside; another end cover is joined to the other axial
25 end portion of increased wall thickness on the inner side surface of the inner cylinder and the end covers are each joined at one end to the outer cylinder to provide a watertight container; and a resin is filled in a vacant

1 space within the watertight container and allowed to
harden. In the stator of the submerged motor according
to the invention produced by the production method accord-
ing to the invention, an axial central portion of the wall
5 of the inner cylinder is smaller in thickness than in
the axial opposite end portions, so that an eddy current
loss can be reduced, and the axial opposite end portions
of the wall of the inner cylinder which are greater in
thickness than the axial central portion have increased
10 mechanical strength to enable joining to the end covers
to be readily effected. In assembling, fitting the stator
core in the outer cylinder and inserting a rotor into the
stator can be readily effected because the increased wall
thickness portions of the inner cylinder at opposite axial
15 end portions thereof are located on the outer side surface
at one end portion and on the inner side surface at the
other end portion. These features are advantageous when
incorporated in a stator of a submerged motor of the type
described.

WHAT IS CLAIMED IS:

1. A stator of a submerged motor comprising:

a stator core (1) having a winding (2) applied thereto;

5 an outer cylinder (3) supporting said stator core at the outside;

an inner cylinder (4) supporting said stator core (1) at the inside; and

10 end covers (5a, 5b) joining said outer and inner cylinders together at end portions thereof to provide a watertight container composed of said outer and inner cylinders and said end covers and having a resin filled in a vacant space and allowed to harden; wherein the improvement comprises:

15 increased wall thickness portions (6a, 6b) formed at said inner cylinder (4) at axial opposite end portions thereof in the vicinity of joints of the inner cylinder (4) with the end covers (5a, 5b), one of said increased wall thickness portions (6a) being formed on an outer side surface of one axial end portion and the other increased wall thickness portion (6b) being formed on an inner side surface of the other axial end portion.

20 2. A stator of a submerged motor as claimed in claim 1, wherein said increased wall thickness portions
25 comprise reinforcing layers formed on the outer side surface at one axial end portion and on the inner side surface at the other axial end portion.

5 3. A stator of a submerged motor as claimed in claim 2, wherein said reinforcing layers are each formed with a screw thread on an outer peripheral surface and said end covers are each formed with a screw thread on an inner peripheral surface of an inner end portion on the side of the inner cylinder, and the reinforcing layers and the end covers are threadably joined to each other with an adhesive layer being interposed therebetween.

10 4. A stator of a submerged motor as claimed in claim 3, further comprising metal rings (12a, 12b) fitted over the inner side surface of the inner cylinder in positions corresponding to the reinforcing layers and maintained in intimate contact therewith.

15 5. A stator of a submerged motor as claimed in claim 4, wherein said metal rings (12a, 12b) are formed of metal equal to or larger than the metal for forming said end covers in the coefficient of linear expansion.

20 6. A stator of a submerged motor as claimed in claim 2, wherein said reinforcing layers are each formed with a screw thread on an inner peripheral surface and said end covers are each formed with a screw thread on an outer peripheral surface of a flange at its end portion on the side of the inner cylinder, and the reinforcing layers and the end covers are threadably joined to each other with an adhesive layer being interposed therebetween.

25 7. A stator of a submerged motor as claimed in claim 2, wherein said reinforcing layers are each formed with a screw thread at a portion of its inner peripheral surface located remote from its axial end and a diverging tapering at a portion thereof extending from the threaded

30

portion to the axial end, and said end covers are each formed with a screw thread at a forward end portion of its outer peripheral surface and a converging tapering at a portion thereof corresponding to said diverging tapering of the corresponding reinforcing layer, and the reinforcing layers and the end covers are threadably joined to each other at their screw threads and adhesively joined to each other at their taperings.

8. A stator of a submerged motor as claimed in claim 6, wherein said reinforcing layers are each formed with a screw thread at an outer peripheral surface and said end covers are each formed with an additional flange extending along the outer peripheral surface of the respective reinforcing layer and formed with a screw thread on an inner peripheral surface thereof, and the reinforcing layers and the flanges are threadably joined to each other with an adhesive layer being interposed therebetween.

9. A method of producing a stator of a submerged motor comprising the steps of:

supporting a stator core with a winding at the outside by an outer cylinder and supporting said stator core at the inside by an inner cylinder in a predetermined position, said inner cylinder being formed with increased wall thickness portions at axial end portions thereof, one at one end portion on an outer side surface thereof and the other at the other end portion on an inner side surface thereof, said inner cylinder having one end cover joined thereto at the one end portion having the increased

wall thickness portion on the outer side surface and
moved with the other end portion having the increased
wall thickness portion on the inner side surface serving
as a leading end portion until the said predetermined
5 position is reached;

joining another end cover to the said the other
end portion of the inner cylinder having the increased
wall thickness portion on the inner side surface thereof;

joining said end covers at one end thereof to
10 said outer cylinder to provide a watertight container; and
filling a resin in a vacant space within said
watertight container and allowing same to harden.

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FIG. 1

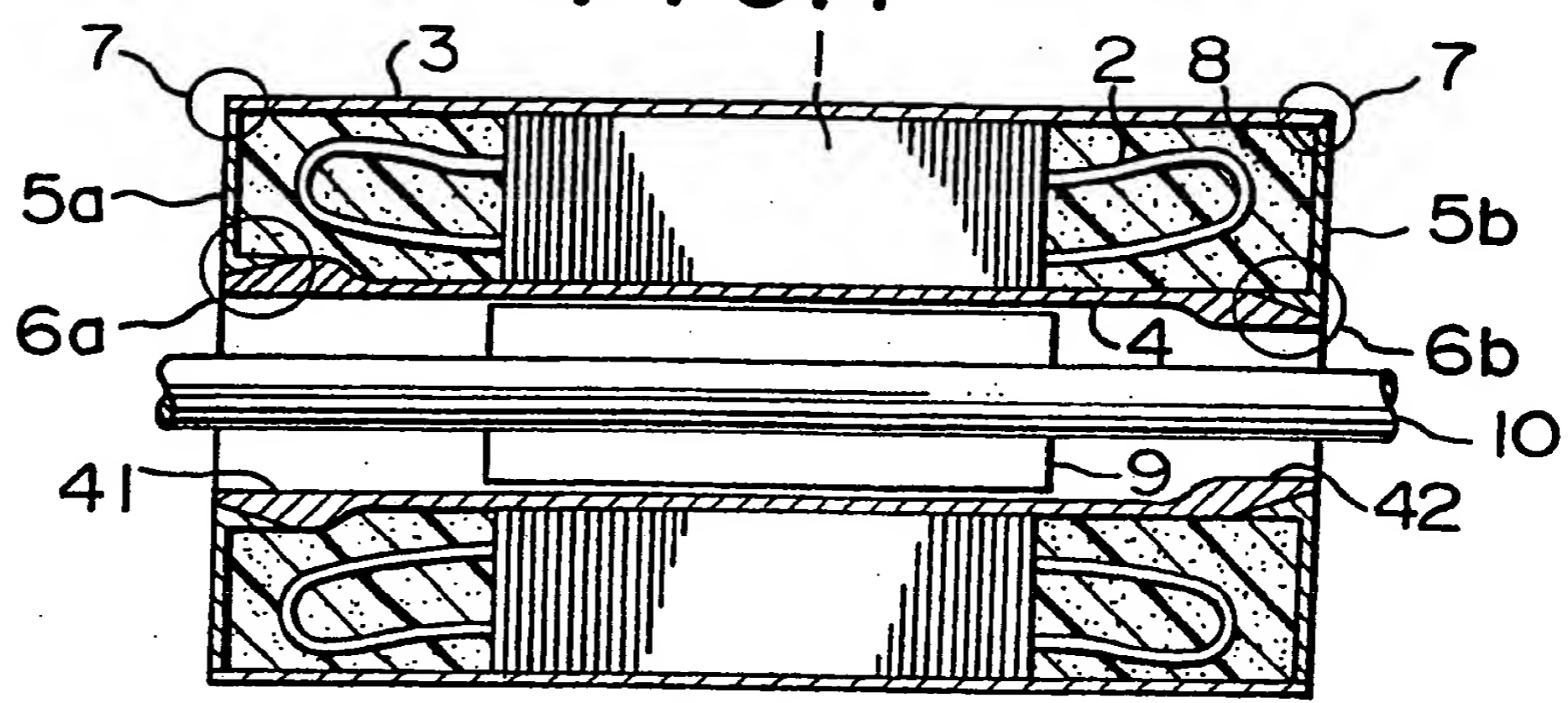


FIG. 2

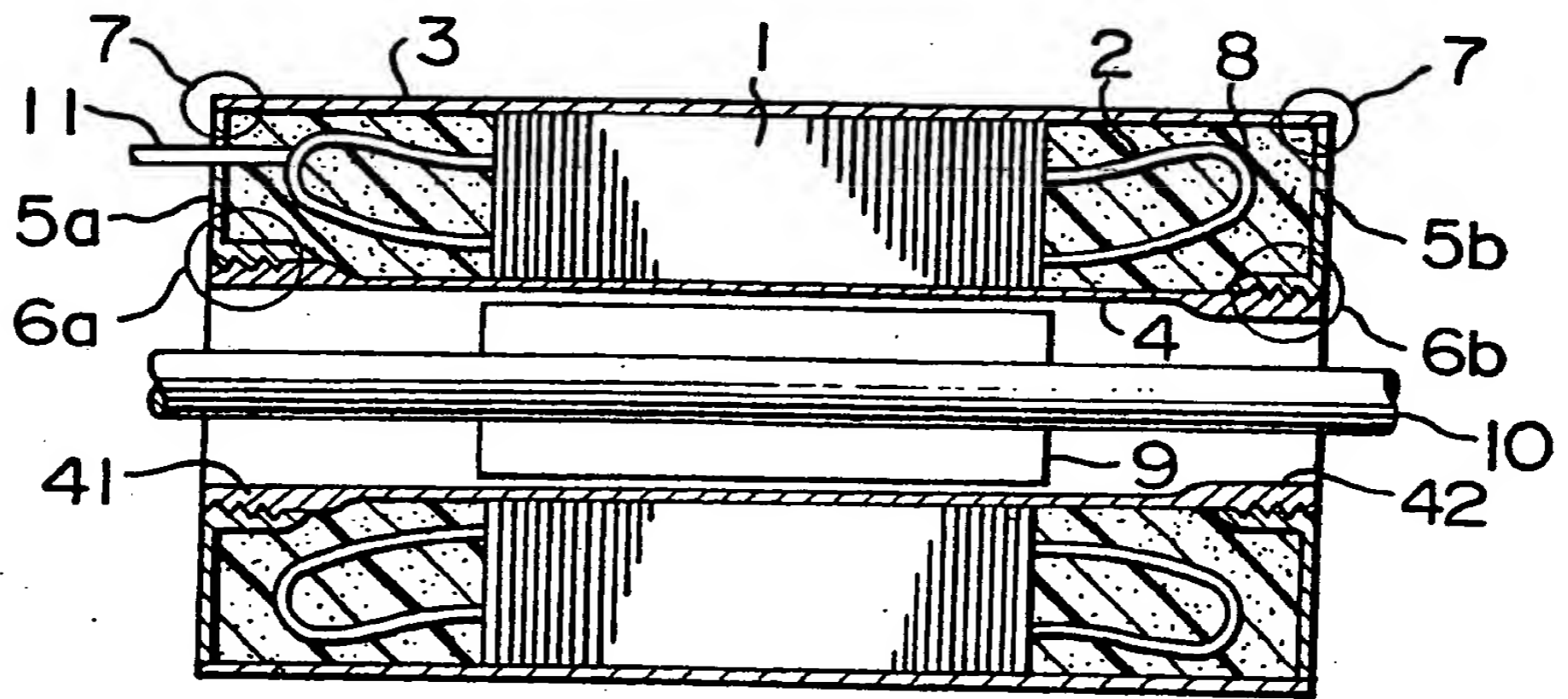
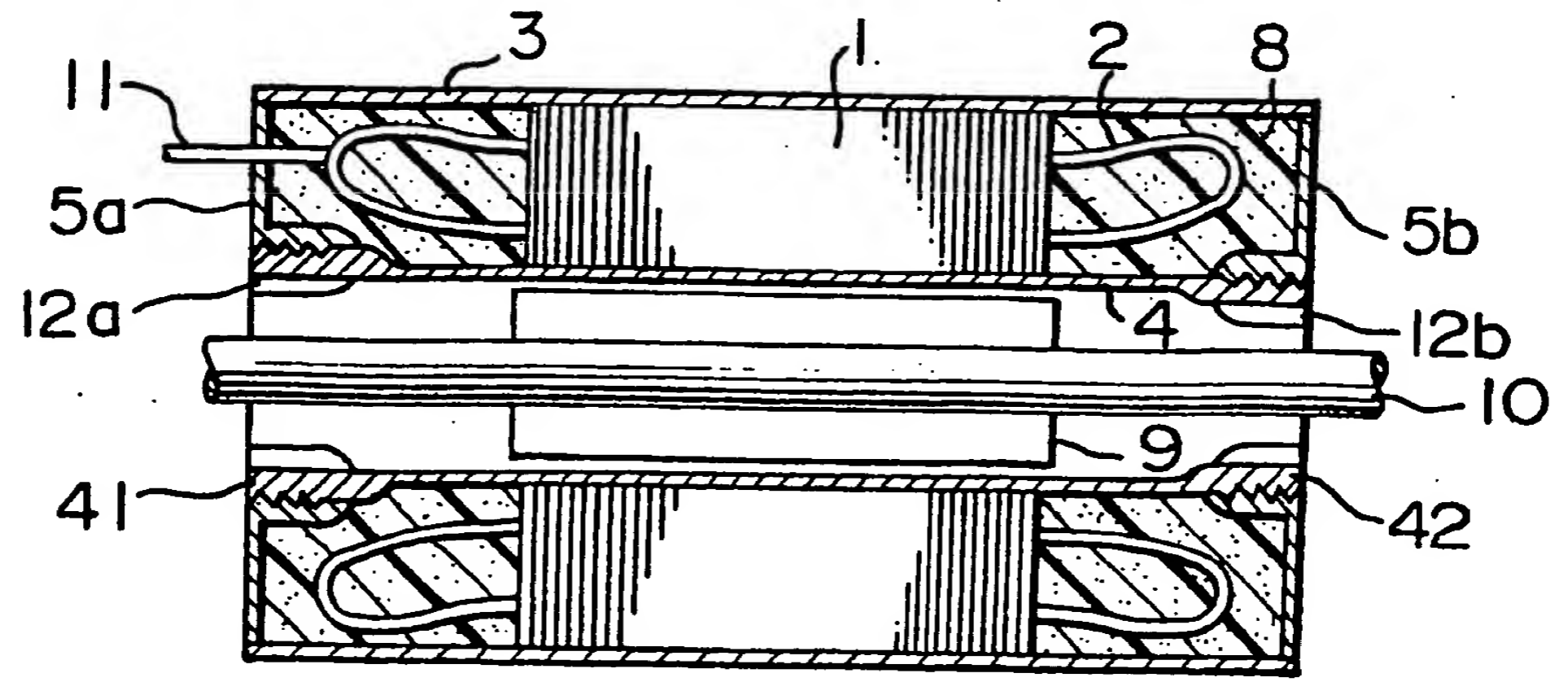


FIG. 3



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FIG. 4

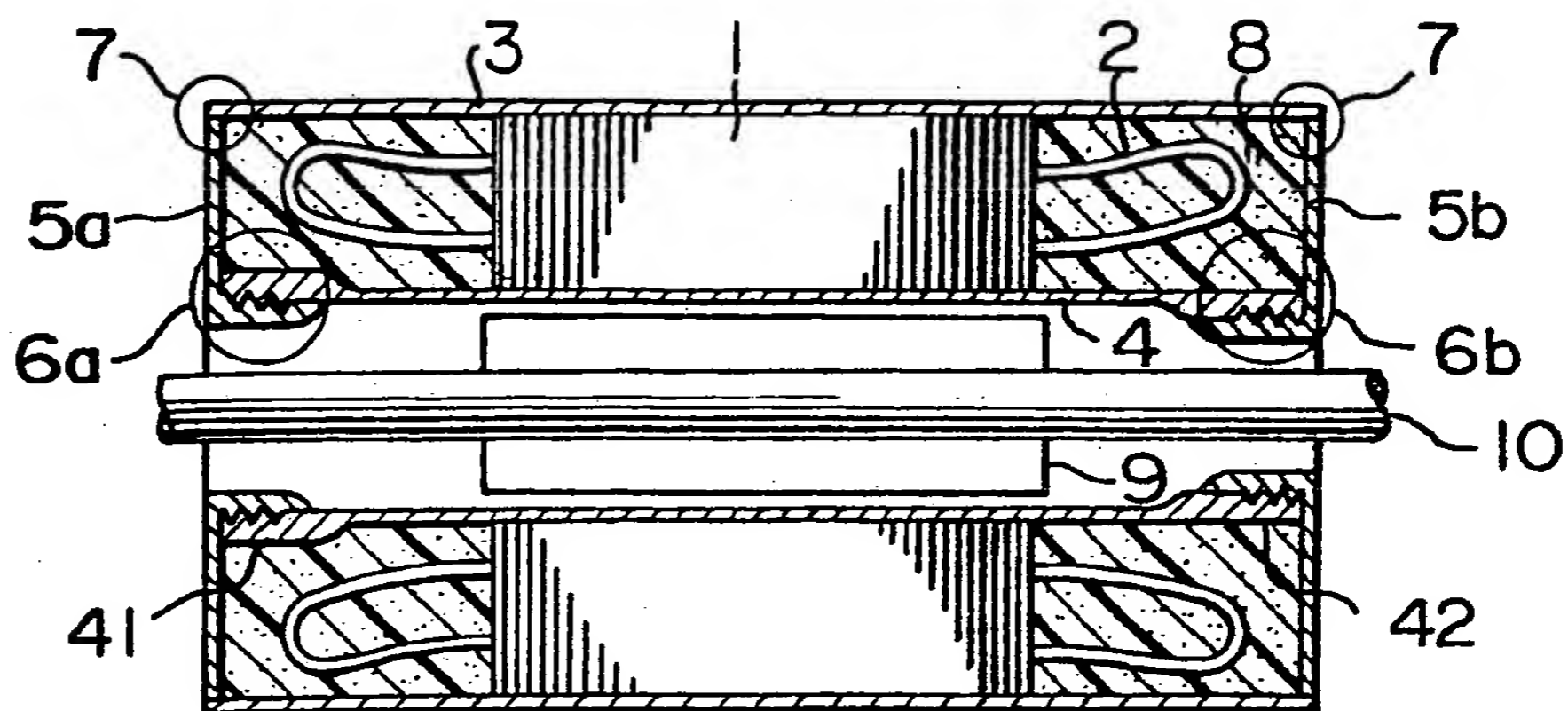


FIG. 5

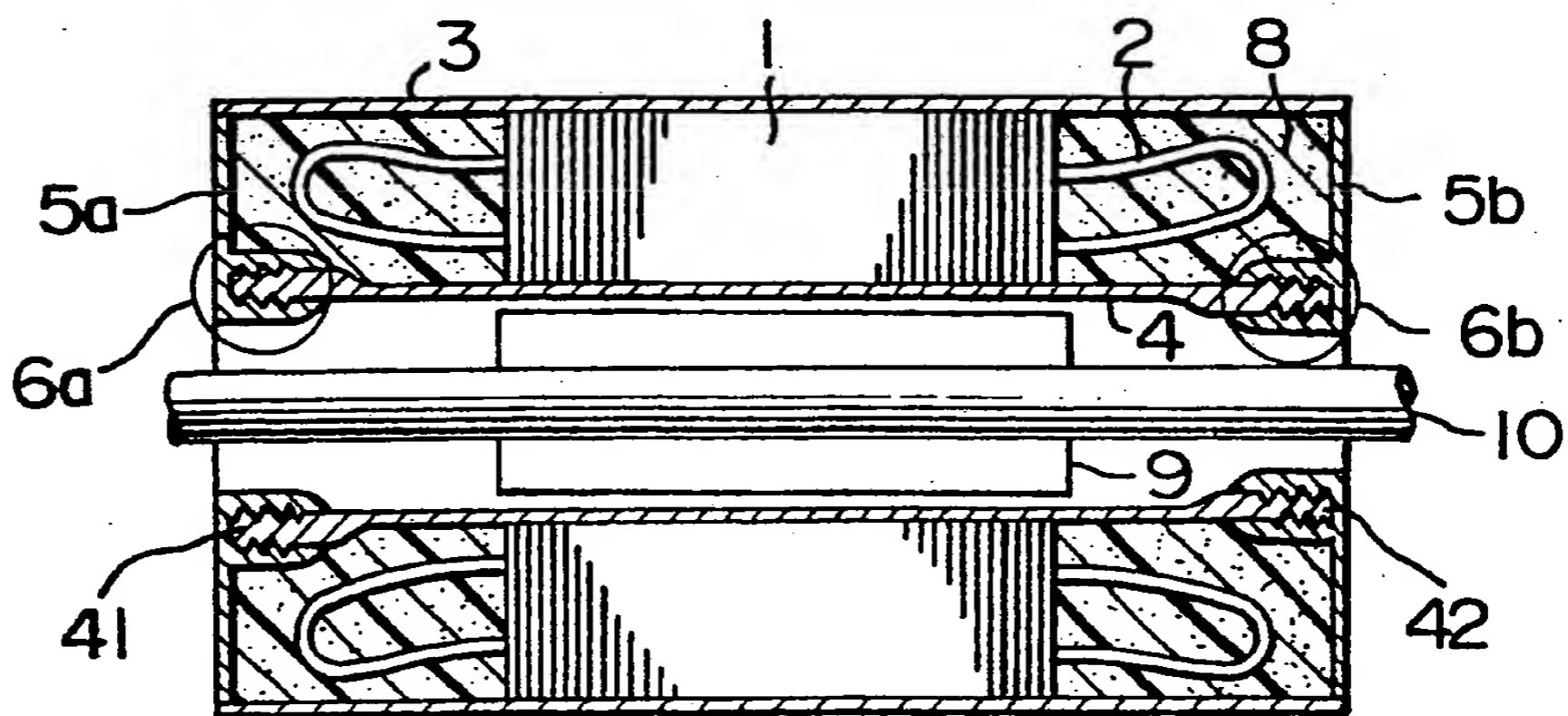
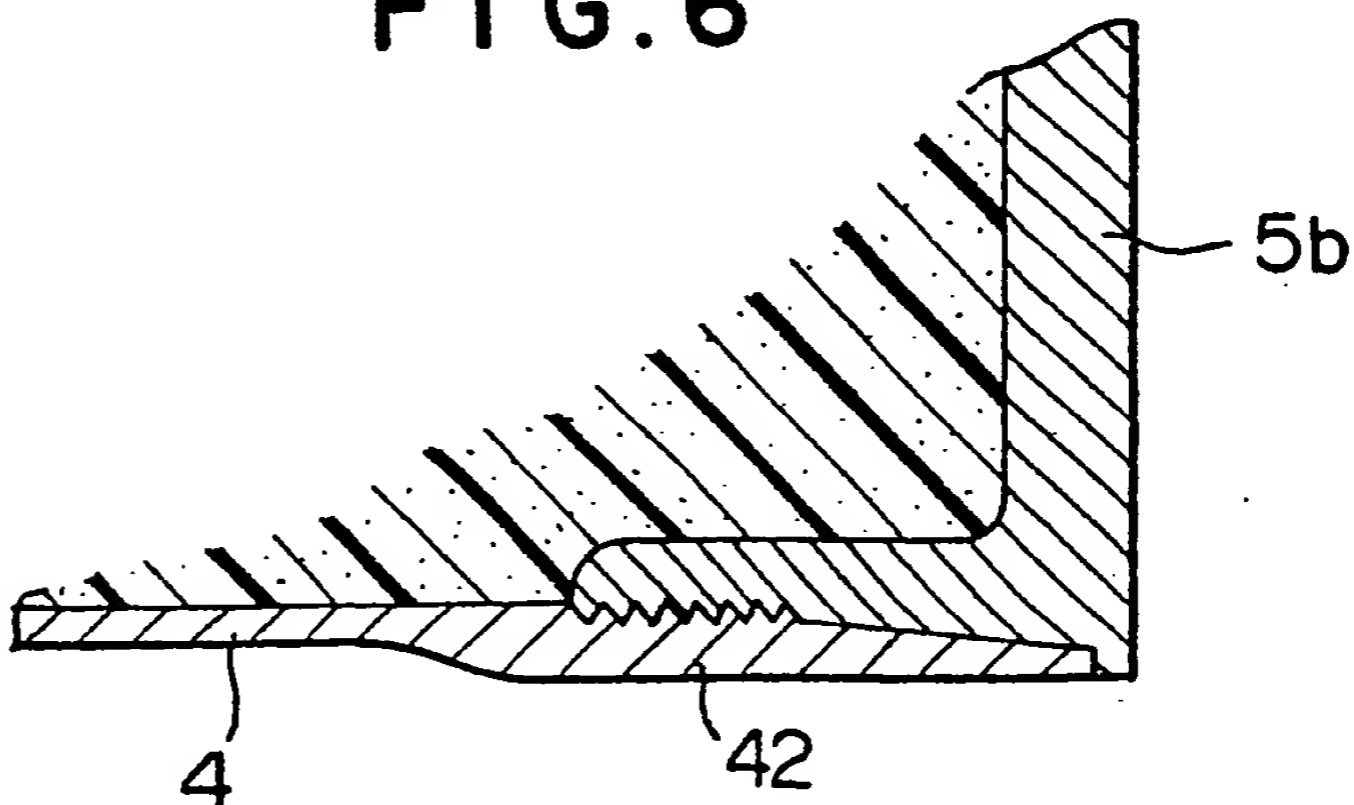


FIG. 6





European Patent
Office

EUROPEAN SEARCH REPORT

0111764
Application number

EP 83 11 1547

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| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int. Cl. 3) |
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| The present search report has been drawn up for all claims | | | |
| Place of search BERLIN | | Date of completion of the search 14-02-1984 | Examiner GESSNER E A F |
| CATEGORY OF CITED DOCUMENTS | | | |
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